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Manufacturing Technology Division

- Electronics
- Processing and Fabrication
- Integration and Technology

"Integrating Air Force and industry requirements to help provide advanced manufacturing processes, techniques and systems for the timely, reliable, high quality, economical production and sustainment of Air Force systems."

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AF ManTech
UNITED STATES AIR FORCE
Highlights

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Fall 2004
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ManTech milestones…

The Air Force Manufacturing Technology (ManTech) Division awarded a Small Business Innovative Research Enhancement contract for an Improved Titanium Machining Process. The original contract advanced the development of a finite element code for machining, with an emphasis on high speed machining of titanium. The 12 month enhancement seeks to expand the capability of the code by adapting its use to milling and drilling operations with a special emphasis on titanium plate products. It's expected that cycle time for titanium plate parts will be reduced by 30 percent, and result in a cost savings of at least $44K per aircraft.

CAI Program Analyzes F-35 Costs: Use of the Composites Affordability Initiative (CAI) modified SEER-DFM (not an acronym) direct cost modeling system has enabled the F-35 team to use a common program for cost analysis. Full team acceptance of the cost modeling system for the F-35 has resulted in faster response times to the engineering team, offered the opportunity for an increase in the number of cost trades and reduced the cost of in-house and contracted component fabrication. This cost modeling system has facilitated the optimization of resources considering the dynamic changes that are happening on the F-35 program. ManTech is a member of the CAI consortium.

ManTech "Arrays" Successful Program Rollout in September: Completing a full electro-optical evaluation of Focal Plane Arrays (FPAs) built on recently available 4" InSb wafers as part of the ManTech Infrared Focal Plane Array Process Fabrication Improvement Program. It is estimated that use of the larger wafers will reduce production cost of the FPAs by 50 percent for the F-35 Joint Strike Fighter.

Metals Affordability Initiative Team Slates Testing For September: ManTech recently announced that qualification testing for four F-15 prototype vertical tail picture frames produced using single melt titanium under the Metals Affordability Initiative (MAI) Electron Beam Titanium Slab Program, is scheduled for March 2005. These new tail frames provide a platform for new skins on the vertical tail and were produced using advanced high speed machining techniques and the single melt process, produced in a cost-reduction effort in an MAI program.

ManTech Supports Industrial Base Assessment for National Security Space Architect (NSSA): The Manufacturing Technology (ManTech) Division met with NSSA recently, and has been asked to be the principal integrating organization for their FY06 Space Program Assessment Industrial Base Assessment Integrated Product Team (IPT). Working with NSSA, ManTech will be integrating the efforts of the IPT with participation from several other government agencies, including the Army and the Navy, to identify industrial base constraints and recommended policy/collaboration/funding actions. As a part of the overall FY06 Space Program Assessment, the Industrial Base Assessment IPT's efforts will be presented in August.

The Manufacturing Technology Division Briefs Engine Cost Savings Initiative to JSF Program Office Propulsion Community: The ManTech Division identified common cost and cycle time drivers of the F135 and F136 weapon systems for the F-35 Joint Strike Fighter, and encouraged the engine companies to work together for the benefit of the DoD. Pratt & Whitney and General Electric have joined forces to develop manufacturing programs to address the high cost and cycle time drivers of the F135 and F136 engines. The F-35 Program Office Propulsion folks were very interested in the manufacturing initiative, and encouraged the team to continue to develop cooperative programs that will benefit both weapon systems. Pratt & Whitney and General Electric will continue to work with ManTech to develop detailed business cases for the cooperative efforts and brief the management chain.

Contact the Technical Information and Support Center at techinfo@afrl.af.mil or calling (937) 255-4689.

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UNITED STATES AIR FORCE

ManTech Highlights is an unofficial publication (cleared for public release) for the promotion of information relevant to, and about, the people and programs of the Manufacturing Technology Division of the Air Force Research Laboratory (AFRL) Materials and Manufacturing Directorate at Wright-Patterson AFB, Ohio.
ManTech Highlights is published quarterly with scheduled distribution dates in Winter, Spring, Summer and Fall.
Submit information or ideas for future articles to the editor at (937) 255-4689 techinfo@wpafb.af.mil.
To help disseminate the information contained in the *ManTech Highlights*, you [redacted] urage [redacted] s pres[redacted] ies of [redacted] *653,* [redacted] afb.af.m[redacted]

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ManTech Engineer Receives Science and Engineering Award

By Gary Cunningham
AFRL Manufacturing Technology Division

WRIGHT-PATTERSON AFB, Ohio – Ray Linville, an engineer with the Manufacturing Technology (ManTech) Division, of the Materials and Manufacturing Directorate (ML) at the Air Force Research Laboratory (AFRL), is the recipient of the 2003 Air Force Science and Engineering Award (Manufacturing category).

Dr. Alexander Levis, Air Force Chief Scientist, approved the award, citing Mr. Linville's outstanding abilities in personally defining, leading and managing programs in support of Laser Eye Protection and the Viper™ Laser. The Viper™ Laser is one of the primary components in the Large Aircraft Infrared Countermeasures (LAIRCM) system, designed to protect C-17s, C-130s and other large aircraft from IR-guided surface-to-air missiles. Dr. Levis also applauded Mr. Linville's contributions to cost reduction and yield enhancement for the Viper™ that will result in more LAIRCM systems being made available to the fleet, increasing aircraft and flight crew survivability in hostile threat scenarios.

Major Gen. Paul D. Nielsen, AFRL commander, presented the award to Mr. Linville during a recent ML Director's Call.

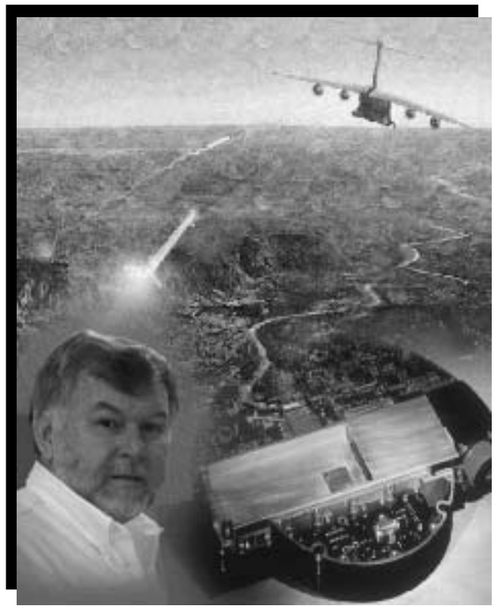
The LAIRCM autonomously detects and signals the flight crew when the aircraft is threatened. It tracks, and then jams the missile's guidance system, resulting in saved aircraft and aircrews. Test experts completed live-fire testing on the Large Aircraft Infrared Countermeasures system last summer, in White Sands, N.M., putting the program ahead of schedule, allowing delivery of the first laser-protected transport to Air Mobility Command late last year instead of the Spring of 2004.

Reduced acquisition and maintenance costs are expected to result in a net savings of $4.2 million, doubling the return on the ManTech investment of $2.1 million. Perhaps equally important is the dramatic increase in yield and reliability improvements, which are expected to result in enormous reductions in life cycle costs and increased system availability.

Linville, the ManTech program manager, and Northrop Grumman representatives believed costs could be reduced for the Viper™ by addressing manufacturability, maintainability, reliability, supportability and availability issues. These cost reductions will, in turn, save money on the entire LAIRCM program.

One of the major obstacles that were overcome through the efforts of Linville and his team was that high value electronics, optics and other materials were only available from a single supplier. Multiple supplier sources were made available, creating more competition and driving the cost down, by substituting standardized components for the specialized ones. In earning the Air Force award, Linville was also cited for taking additional steps to insure success, such as the insertion of Lean practices and principles to increase yield, reduce rework and touch labor costs. In general, design changes were made that reduced deficiencies and the number of assembly and adjustment steps for the electronic and optical components.

For more information on this program call the Technology Information Center at (937) 255-4689, and refer to item **04-013.**



Mr. Ray Linville, program manager for the Manufacturing Technology Division's Viper™ Laser project team, recently received the 2003 Air Force Science and Engineering Award (Manufacturing category).
(Graphic Composed by Michael Ross)

ManTech's Electronic Parts Obsolescence Initiative (EPOI) produces $22 Million In Cost Savings…So Far

By Gary Cunningham
AFRL Manufacturing Technology Division

WRIGHT-PATTERSON AFB, Ohio – Led by the Manufacturing Technology (ManTech) Division of the Air Force Research Laboratory's Materials and Manufacturing Directorate, the Air Force has witnessed a savings of more than ***$22 million*** in a year thanks to the Electronic Parts Obsolescence Initiative (EPOI).

According to Tony Bumbalough, ManTech project manager for EPOI, Northrop Grumman, a member of EPOI, successfully conducted the first of two pilot demonstration programs, and documented the savings by integrating a number of proactive practices and procedures, and commercially available tools that resulted in huge cost decreases in areas such as materials, redesign, production and sales.

"These savings stem from EPOI efforts to solve real world concerns such as obsolescence prediction, life cycle cost estimation and commercial off the shelf (COTS) reliability prediction," Bumbalough explained. "That $22 million, however, should double by July (2004) when Lockheed Martin conducts the second pilot program. It's expected to document roughly the same annual levels of savings."

The F-15 Eagle, a prime candidate to benefit from gains made under the Electronic Parts Obsolescence Initiative. (U.S. Air Force Photo)

Parts obsolescence, in general, results from Diminishing Manufacturing Sources and Material Shortages (DMSMS), and has been a growing problem impacting mission readiness, and costing the government millions of dollars every year.

DMSMS is prevalent in the Air Force's fielded and developmental systems where the service life or development cycle has become longer than the manufacturing life of one or more of its components. Because of DMSMS, for instance, there are program budgets that include millions of dollars annually just to replace "old (obsolete)" avionics hardware, because of electronic parts obsolescence.

Electronic parts obsolescence is caused by several factors. Chief among them has been the decrease in the average life cycle of an integrated circuit (IC) due to technological advances, while the life cycle of America's weapon systems has increased. EPOI is about predicting and proactively managing obsolescence in the most affordable manner. Understanding the impact that system design and redesign cycles have on obsolescence issues is paramount.

Yet another factor that contributes to obsolescence is a purely profit driven one. Public consumption of electronics is far greater (more profitable), dwarfing the military demand. So, it's much less profitable to manufacture parts that are unique to the military.

(continued from page 3)

EPOI consists of three major sections:

Decision and Reengineering Tools

The decision tools are corporate decision tools, which take into account the user's business case. This allows the tool to have weighted factors based on the user's priorities and focus. One example of a decision tool captures, develops and incorporates predictive data elements to enable effective trade-off and solution analyses. When these decision tools are applied, the user should be able to predict obsolescence, schedule for technology refresh and upgrades, and program for the money so it is available when needed.

Reengineering parts, boards, or boxes has always been very time consuming and expensive. The reengineering tools developed under this initiative have automated the process, making it less expensive and manufactured more quickly. The effort is providing automated model generation tools, libraries of simulatable and synthesizable virtual components, and legacy software modeling in a relatively short period of time.

EPOI success is also crucial to the continued viability of the aging fleet of F-16 Falcons. (U.S. Air Force Photo)

Application of Commercially Manufactured Electronics (ACME)

An ever-decreasing availability and higher cost of military unique parts has led many to Commercial off-the-shelf (COTS) parts instead of military qualified parts. The ACME section of EPOI addresses some of these issues by enhancing physics-of-failure models to accommodate COTS parts.

There is not a lot of reliability data on using COTS parts in the warfighter's weapons systems, and qualification testing can be very time consuming and expensive. What the COTS user needs is confidence that the part they are using will work in their environment, and for how long. Motorola developed a neural-network-based software tool that integrates validated physics-of-failure models. Northrop Grumman and the Georgia Institute of Technology developed life-cycle prediction for commercially manufactured Application Specific Integrated Circuits (ASICs) and will validate the reliability models during their pilot program.

Boeing enhanced its durability tool to predict reliability on the basis of a part's technology and manufacturing process. Currently, Boeing's tool is the only one that can simulate testing vibration and thermal at the same time. By using one of these models the user will be able to tell which part on a board will fail first and when. This knowledge will allow planned maintenance, designing problem parts out, supplying spares, etc.

Pilot Demonstrations

Finally, through demonstrations with Lockheed Martin, a system's integrator, and Northrop Grumman, a sub-system designer, EPOI is demonstrating the merits of the corporate obsolescence management approach for different business strategies.

Bumbalough asserts that EPOI has introduced processes and tools into the electronic parts obsolescence issue that have documented and will enable cost reductions in the millions of dollars range, more than $22 million and counting, he also knows that EPOI successes are keeping the warfighter's aging aircraft fleet aloft in a safer and more affordable manner.

For more information on EPOI, contact the Technology Information Center at (937) 255-4689. Refer to item number **03-463**.

receiving the priorities needed to support Operations Enduring Freedom (OEF) and Iraqi Freedom (OIF). His work is (continued from page 8) extremely important to the overall operation. It's comforting to know we can count on his professionalism and dedication to get the job done as we move forward."

The award citation also noted that during both OEF and OIF, Mr. Neely has provided Special Priorities Assistance in support of critical requirements for weapon systems, such as the Global Hawk LR-100 Electronic Support Measure, C-130 armor, Electronic Warfare test equipment, biological protection shelters and communication network infrastructure.

"Mr. Neely personally worked with manufacturers to resolve production conflicts between DoD rated orders and achieved accelerated delivery requirements critical to the prosecution of the air war," Secretary Engle explained. "His efforts directly supported the successful mission execution of Air Combat Command, Air Mobility Command, the U.S. Special Operations Command, and the U.S. Central Command.

"As the program manager responsible for the Air Force Materiel Command's (AFMC) implementation of the DMSMS, Mr. Neely has been instrumental in the development of tools and processes for the Product and Air Logistics Centers (ALC) for use in identifying and resolving problems with the loss of manufacturing sources. Since assuming this responsibility in the mid-90s, he has been responsible for the Air Force being recognized as a leader among the military services in the management of DMSMS issues. In the past year alone, Mr. Neely established processes and procedures for effective management of the risk of avionics components obsolescence across AFMC managed weapon systems."

The citation also marked the close working relationship between Mr. Neely and the AFMC ALCs to define selection criteria for data loading and maintenance of a command-wide DMSMS management tool. This tool provides critical information used to support the ALC's investment of more than $48 million to supply chain managers for DMSMS management of avionics components. There were more of Mr. Neely's accomplishments listed in the citation, but the one that stands out is his success as the chairperson for the DoD DMSMS Conference (held every 18 months). He was chosen to orchestrate the past three, the last one being in 2003, where he actually wore "two hats" since the Air Force was also hosting the event.

More than 500 representatives from the government and industry participated in focusing on the need for proactive DMSMS management by examining innovative approaches in managing the ever-present parts obsolescence problem. Under Mr. Neely's leadership this successful conference presented an opportunity for the DMSMS community to hear the views of military leaders on what will be required to support the modern warfighter and provided a forum to discuss the best programmatic, technical and logistics approaches.

In summing up the overwhelming accomplishments that earned this prestigious Air Force award for Mr. Neely, Secretary Engle stated, "James (Neely) has excelled in his responsibilities as the Air Force Lead for DPAS Title I of the Defense Production Act and program manager for Air Force Materiel Command DMSMS program. His leadership enabled DPAS Title I resources to accelerate delivery of weapon systems to the warfighter for OEF and OIF. His willingness to accept responsibility, leadership, and managerial excellence has earned the respect of his peers and superiors."

For more information on DMSMS or DPAS, contact the Technology Information Center by calling (937) 255-4689, or emailing techinfo@afrl.af.mil. Refer to item 04-014.

"It's comforting to know we can count on his professionalism and dedication to get the job done..."

Deputy Secretary Engle

(continued from page 7)
version for finite elements. The results were an analysis tool that showed a significant improvement in bonded and co-cured joint strength prediction capabilities. Preliminary applications demonstrated on a wing root step-lap joint (connecting point of the wing to the fuselage), and to an F-35's inlet duct assembly joints, as well as an independent validation increased program confidence to use this tool on additional structures. All data gathered showed that StressCheck™ was an improvement over existing analysis tools.

Initially, the F-35 program evaluated the use of this software tool to analyze inlet duct assembly joints. As a result of the success with this initial application, the value of the StressCheck™ analysis tool has been recognized for stress analysis of complex composite structural details and the use of this software on the F-35 program has expanded. Development of StressCheck™ electronic handbooks, a unique feature of this tool (reducing modeling time), has been considered for other F-35 details as well.

Increased confidence in analysis tools has the potential to minimize the amount of physical testing and reduce their impact to cost and schedule.

StressCheck™ is currently being used on the F-35 and X-45C. Additional applications are being considered for other Department of Defense, as well as commercial product usage. Follow-on CAI activities, such as the new StressCheck™ global/local procedures, experimental validation activities and improved composites failure criteria are also of interest to the F-35 program.

For more information on this program, or other efforts by the CAI Team, call the Technology Information Center at (937) 255-4689, refer to item 03-251, or e-mail techinfocenter@afrl.af.mil

Neely Receives Air Force Honors

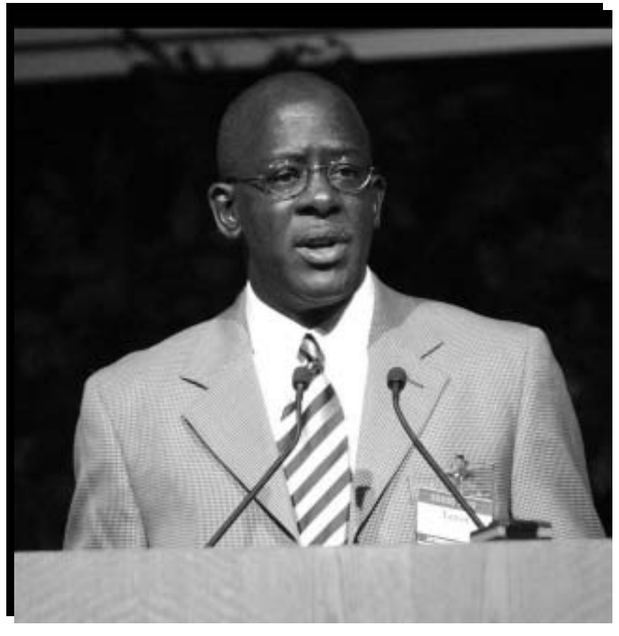
By Gary Cunningham
AFRL Manufacturing Technology Division

WRIGHT-PATTERSON AFB, Ohio – James A. Neely, assigned to the Manufacturing Technology (ManTech) Division of the Air Force Research Laboratory's (AFRL) Material and Manufacturing Directorate, has received the Air Force Exemplary Civilian Service Award.

The award is given annually to a group or individual who, for at least one year, performed their assigned duties in an outstanding manner, significantly contributing to the accomplishment of the command mission.

Dr. James B. Engle, Deputy Assistant Secretary of the Air Force for Science, Technology and Engineering, noted in the citation that Mr. Neely was recognized for his outstanding leadership and management skills as the Air Force Lead for the Defense Priorities and Allocations System (DPAS - Title I of the Defense Production Act), and for his work as the program manager responsible for Air Force Materiel Command implementation of the Diminishing Manufacturing Sources and Materials Shortages (DMSMS) program.

Summing up what he calls the consensus opinion of Mr. Neely's outstanding dedication to his work, Secretary Engle said, "Mr. Neely's superb work is ensuring that Air Force high demand weapon systems are



Mr. James Neely (Photo courtesy of UTC)

Extending Gas Turbine Engine Blade Life

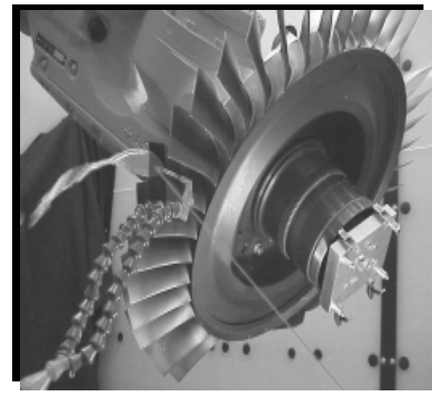
By Gary Cunningham
AFRL Materials and Manufacturing Directorate

WRIGHT PATTERSON AIR FORCE BASE, Ohio – Officials from the Manufacturing Technology (ManTech) Division, of the Air Force Research Laboratory's Materials and Manufacturing Directorate here, in partnership with LSP Technologies, Inc. (LSPT), of Dublin, Ohio, are anticipating even greater cost savings for the warfighter in the future as their RapidCoater™ introduces automation to the Laser Shock Peening (LSP) program.

LSP is concerned with extending the blade life of gas turbine engines. In the early 1990s, the B-1B Lancer's F101 engine began experiencing titanium turbine blade failure due to foreign object damage (FOD) caused by ice and hard objects ingested into the engine. Several catastrophic engine failures occurred from fatigue cracks, resulting from FOD on the leading edges of first stage fan blades. In several cases, chunks of blades broke loose and destroyed the rest of the engine. Based on this, Air Force officials estimated that one to two engines would be lost per year.

To avoid grounding the entire B-1 fleet, the Air Force established a requirement that a manual inspection of all the fan blades take place before each flight. The time-consuming leading edge inspections involved rubbing the leading edge of each blade with cotton balls, cotton gloves and even dental floss. If a single snag was detected, the aircraft was grounded, engine removed and the blade was replaced prior to the next sortie.
By 1994 it was estimated that it took more than one million man-hours to complete these costly and time consuming engine inspections and keep the B-1 flying.

In that same year LSP, a little known technology at the time, was under development at General Electric Aircraft Engines (GEAE) under license from Battelle Memorial Institute. GEAE was investigating this new process as a potential solution to increase the overall strength and durability of titanium fan blades.
David See, ManTech's LSP program manager, explained, "LSP uses a strong laser impulse to impart high compressive residual stresses in the surface of the metal leading edge components. The laser pulse ignites a blast or shock wave from the specially coated surface of the component. The expansion of the blast wave then creates a traveling acoustic wave that is coupled into the component, thereby compressing the material lattice structure. The resulting surface compressive residual stress significantly improves the high cycle fatigue properties of the component and greatly increases resistance to blade failure caused by FOD."



Laser beam strikes turbine fan blade. (Photo courtesy LSP Technologies,Inc.)

"For instance," See continued, "a typical untreated, undamaged fan blade has a fatigue strength of 100 ksi (thousands of pounds per square inch) in high cycle fatigue testing. When a small amount of FOD is introduced, this strength can be reduced to less than 20 ksi, or less than half of the design requirement. However, when LSP-treated blades are comparably damaged by the same amount of FOD, they retain their fatigue strength of 100 ksi. So, this demonstration proved that LSP was capable of restoring the structural integrity of a damaged fan blade."
Next, a cooperative ManTech effort investigating LSP demonstrated the ability to virtually eliminate sensitivity for FOD defects up to one-quarter of an inch in an F101 engine fan blade, and in 1995, the Air Force decided to move ahead with the production development of LSP technology, bringing it out of the lab and into the production environment.

(continued froom page 5)
GEAE began application of LSP to production titanium blades in 1997. Although production costs for the new technology were relatively high, the benefits far out weighed the inspection and replacement costs. The reduced FOD sensitivity on the F101 engine eliminated the manual preflight inspection requirements, then running more than $10 million per year, and avoided projected engine losses that conservatively would have cost in excess of $40 million over the life of the F101 engine.

Even though LSP was being hailed as a great step forward in preventing engine blade damage, ManTech and its partner, LSPT, continued to work on improving the process through automation.

At issue was the opaque overlay applied to every blade prior to undergoing LSP that had to be manually reapplied numerous times during processing in order to avoid surface melting and staining. Each laser pulse/explosive interaction damages the coating at the point of impact and around each spot requiring that every other spot and typically every third spot be processed.

Obviously, this manual reapplication of the opaque coating is very tedious, time consuming, and labor intensive. It is also more costly than it need be, and throughput was low.

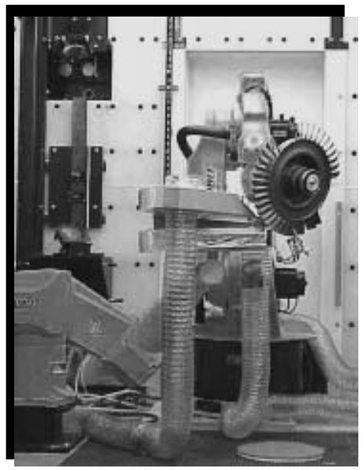
While LSPT and ManTech attacked the needed automation system, the laser benefited from other technological innovations that would increase the processing rate and robustness for placement in the production environment. These features included improved laser glass to allow operation at higher process rates, quick-change components to reduce online maintenance time to a matter of minutes and increase the processing time, and better controls and monitors to manage the health of the laser system and process.

LSPT designed and built the advanced laser system, and then created another technical innovation – the RapidCoater™ system, to further enhance productivity and lower costs.

The RapidCoater™ system is a major innovation to the LaserPeen™ system and laser peening technology in general that (1) increases the process throughput by six to nine times, (2) improves the reliability and repeatability of the process, and (3) lowers the cost of processing by about 40 percent.

The RapidCoater™ system is the ultimate automated method for applying the overlay coatings, spot by spot at high speed. Essentially, it consists of a specialized airbrush spray nozzle, which is computer controlled to apply and remove the overlays at the specified times during the processing of a part.

Computer control on the RapidCoater™ is sequenced with the process control laser to provide the following steps at specified times: a brief spray of a proprietary opaque overlay coating is applied to the spot to be processed, the transparent water overlay is applied over the surface just "painted", the laser beam pulse is applied, the shock wave is generated and the processed area may be cleared with a proprietary removal agent in preparation for the next spot.



The LSP RapidCoater™.
(Photo courtesy of LSP Technologies, Inc,)

All of this requires only a few hundred milliseconds. The part is then indexed to the very next spot and the RapidCoater™ sequence is repeated again for this spot. This process sequence is repeated each spot to be processed on the part until the entire area is processed. Currently, GEAE has three RapidCoater™ production machines operational and in combined efforts with the Air Force, are working application on the F101, as well as the F110 gas turbine engine used in the F-16 Fighting Falcon.

To date, GEAE has treated more than 20,000 F101 blades and transitioned the technology for application on the F110 engine, treating more than 2,000 blades. They're also working to apply the proven LSP technology to other engine components and commercial product lines in a cost-effective manner. Several efforts were then sponsored by ManTech to demonstrate the diversity of LSP and the RapidCoater™.

General Research Corporation International, of Vienna, Va., experimentally demonstrated superior FOD damage tolerance capability for LSP compared with mechanical

(continued from page 6)
shot peening.

LSP Technologies successfully modeled elastic shock wave propagation and corresponding material effects of the LSP process on titanium alloys.

The University of Dayton Research Institute used finite element analysis techniques to predict residual stresses induced by laser shock peening. These successful efforts facilitated development of new applications for LSP.

Current efforts with LSPT are focused on maturing LSP manufacturing capabilities and implementing a commercially affordable production-manufacturing cell for application to individual gas turbine engine blades. LSPT and Pratt and Whitney are also expanding LSP applications to integrally bladed rotors (IBRs) and large components, initially for application in the F119 engine of the F-22 Raptor. This avoided a potential redesign and retrofit that would have cost as much as $10 million.

The commercialization of LSP is also on the way, as leading aerospace equipment manufacturers continue to express keen interest in applying any and all advancements to their industry. One investment under consideration involves conducting component gear fatigue tests aimed at validating the life benefits achieved with the laser peen process.

In these days of tight budgets, and programs graded on return on investment, LSP has come through for ManTech and the Air Force in a big way.

When all benefits are totaled, above and beyond the savings in preflight inspections and avoiding aircraft losses, LSP technology is resulting in a cost avoidance of more than $100 million. Application of this technology has avoided over $59 million in costs through reduced blade replacement costs, reduced secondary damage engine repair costs, and cost avoidance from airfoil failures. By avoiding 42 catastrophic failures over the remaining life of the B-1B/F101 program, another $40 million cost avoidance would be realized. This, added to the money saved in avoiding the redesign of the F119, is a cost avoidance of more than $100 million.

LSP's impact on the F110 has not been determined at this time, but according to See it's projected to be at least as significant as it was on the F119. More importantly, these benefits appear to be just the tip of the iceberg when the expected savings is added up as LSP is applied to all engines across the Air Force fleet.

For more information on LSP, contact the Technology Information Center at (937) 255-4689, or email techinfo@afrl.af.mil. Refer to item **04-092.**

F-35 Program Adds CAI's *StressCheck™* To Analysis Software Suite

Manufacturing Technology (ManTech) Division officials were notified recently that the structural analysis software StressCheck™, initiated and developed by the ManTech led Composite Affordability Initiative (CAI), has been included as a tool in the accepted suite of analysis software for the F-35 (Joint Strike Fighter) program.

Inclusion of the StressCheck™ analysis tool has demonstrated the potential to lower implementation costs by reducing the amount of testing of the F-35's composite structures.

The CAI team consists of the Air Force Research Laboratory's Materials and Manufacturing Directorate and the Air Vehicles Directorate, Boeing, Lockheed Martin, Northrop Grumman, and Bell Helicopter.

The CAI team developed and enhanced the modeling and simulation software, called StressCheck™ P-
(continued on page 8)

The F-35 Joint Strike Fighter
(U.S. Air Force Photos; Composition by Mike Ross)